

Brechtel Manufacturing Incorporated
Model 3V Straight-Thru 3-way Valve Manual
Version 5.0

Date: May 10, 2017

BRECHTEL

Brechtel Manufacturing Inc.
1789 Addison Way, Hayward, CA 94544
510.732.9723 Fax: 510.732.9153
Web: www.brechtel.com
bmi_info@brechtel.com

Contents

1	Introduction	1
2	Background of the Straight-Thru Valve	1
3	Setting up your 3-way valve	2
4	Technical Information about the 3-way Valve	4

1 Introduction

This manual provides technical information describing the setup, use and maintenance of the BMI Model 3V straight-thru 3-way valve. The valve allows automatic switching between two different sample flows under user control via a motor controller board included with the valve. The valve is designed with one straight-through line (see 1) that should be used for flows larger than a few liters-per-minute and with larger diameter aerosol to minimize particle losses. The other, non-straight-through path should be used for sample flows containing smaller aerosol or for lower flow rates when particle losses are less important. It is the user's responsibility to mount the components, complete the electrical hookups and to provide the programming to interface with the motor controller board if the valve assembly is purchased as a stand-alone unit not packaged in a BRECHTEL rack-mountable chassis. The manual should be read in its entirety. Pay special attention to items in italics and boldface.

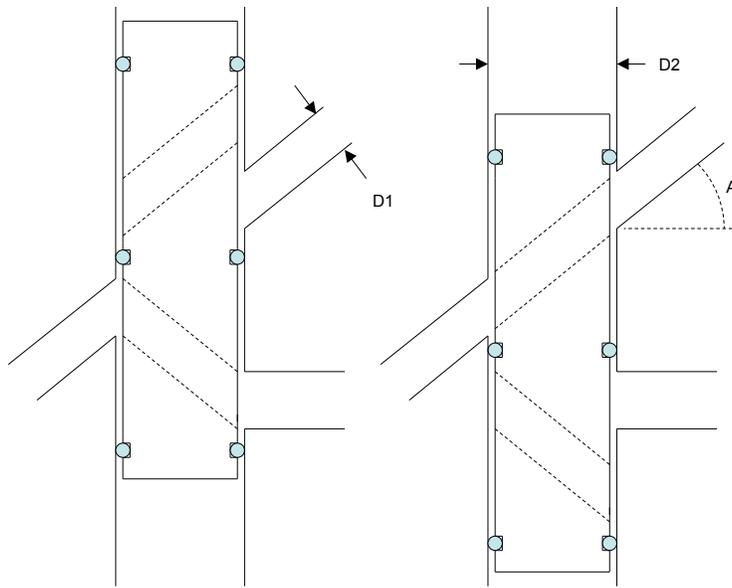


Figure 1: Schematic of the BMI straight-thru 3-way valve. Diameter D1 is 0.5" (inside diameter 0.375"). Diameter D2 is 0.75".

2 Background of the Straight-Thru Valve

The major components of the 3-way valve are shown in figures 2 and 3 and include:

1. the 3-way valve stainless steel body,
2. the aluminum center plunger with O-rings and airflow pass-through holes,

3. limit switches and switch mounting brackets to limit plunger motion,
4. the stepper motor to drive the plunger back and forth inside the body,
- and
5. the motor controller PC board.

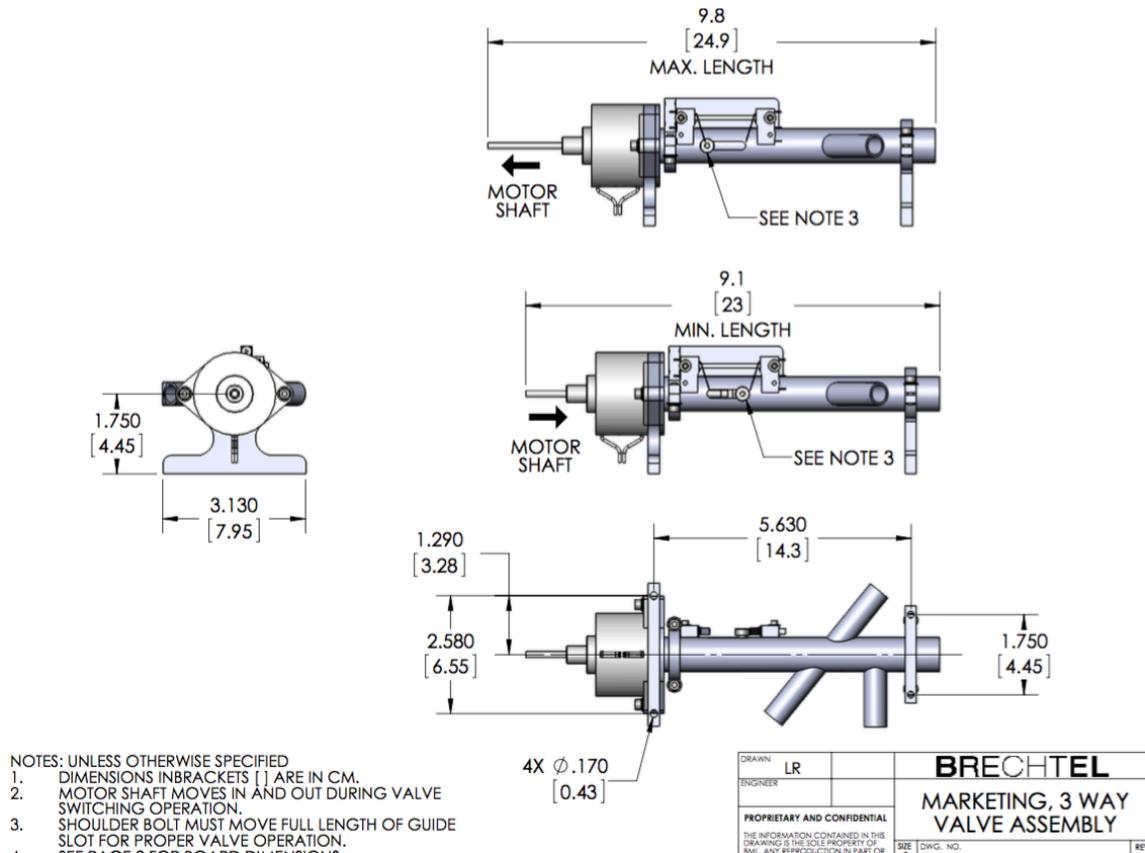


Figure 2: Dimensions of the straight-thru 3-way valve.

The purpose of the straight-thru 3-way valve is to allow quantitative, low-loss sampling of particles over a broad size range within an inlet sampling system that requires switching between two different sources or sample air. Configure the valve so that sample flow containing the largest particle diameter to be measured passes through the straight-through line of the valve.

3 Setting up your 3-way valve

Follow these steps to set up your 3-way valve for operation:

1. The motor controller board is delivered UNCONNECTED to the valve to allow you to interconnect the wiring according to the requirements of your installation. For example, if the valve will be located several feet away from the motor controller board enclosure, then solder the

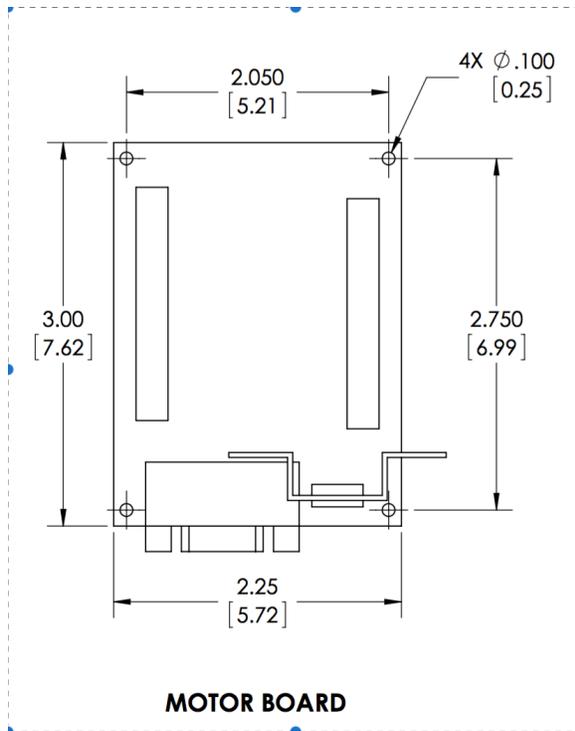


Figure 3: Dimensions of the 3-way valve motor controller board.

appropriately colored leads of the needed length to the motor board wires and run the wire extensions to the board. Be sure to strain relieve the board wire hookups. A terminal strip could be used to facilitate wiring and strain relief.

2. Connect the motor wires to the motor controller board terminals labelled on the board as follows:
 red motor wire connects to terminal WA1,
 black motor wire connects to terminal WA2
 green motor wire connects to terminal WB1
 blue motor wire connects to terminal WB2
3. Connect +12 volt DC power to motor board terminal labeled +Vm; connect DC ground to motor board terminal labeled GND. We recommend installing a small cooling fan near the motor board to avoid overheating the processor on the motor controller board.
4. If control will be via USB, attach a USB cable between your control computer and the USB port of the motor controller board. Follow the detailed instructions for the motor controller board provided on the small CD to communicate with the board.
5. If the valve plunger motion will be limited by limit switches, mechanically mount the limit switches per your requirements so that the head of the guide bolt attached to the plunger just closes each switch at each end of the full range of travel. Solder wires of the appropriate length

for your installation to the switch and attach to the motor board limit sensor positions (LY- to LX+) according to whether you are driving the Y or X motor and to correspond with your sampling needs. See the detailed discussion of the use of limit sensors in the motor controller board manual to properly wire and use your limit switches.

6. Attach your sample flow inlet to the common inlet tube (side of body with only one tube attached) and the appropriate downstream devices to either the straight-thru leg of the valve or the 'bypass' leg of the valve.

4 Technical Information about the 3-way Valve

The 3-way valve has been vacuum leak checked using a vacuum gauge and pump installed on the common outlet tube with one of the input tubes plugged in sequence. Less than a 0.5" Hg drop in pressure was observed over a 30 minute period, indicating that no leakage was occurring past the O-rings on the plunger. The valve assembly has been cycled 1,000 times at BMI prior to shipping to validate proper operation of the valve. The full range travel of the valve is 3000 steps.

Connect to the motor board using USB communications following the instructions included in the manual for the motor controller board. Alternatively, the valve can be driven directly using TTL pulses fed directly to the motor board from a data acquisition system. Upon power up, it is important to recognize that the system does not know the absolute "home position". Invoke the command 3000g followed by a wait period of at least 10 seconds to ensure the valve moves a full 3000 steps. Then invoke the command 0g and the valve should move back 3000 steps. Invoke the command to set home position after the 0g command completes. Once home position is established after power up, the command 0g, will home the valve, or drive the plunger fully in one direction. The command 3000g will drive the valve the full range of travel in the opposite direction. The default settings of the motor controller board were used for testing.

Alternatively, if your valve is equipped with limit switches, then the position of the valve may be determined by recording which switch is closed. The motor controller board only stops the motion of the motor when the limit switch is actuated, it does not 'send' a signal per se to the controlling system communicating the actual position of the valve. External data logging capability (for example a digital input line that is 'high' when the valve has closed one switch and 'low' when the other switch is closed) may be required to adapt the switch closing/opening signal to information revealing the actual position of the valve. It is critical to the proper operation of the valve that the plunger inside moves through the full range of motion defined by the guide slot and shoulder bolt in the side of the valve body - DO NOT allow the limit switches to stop the motion of the plunger before the shoulder bolt physically rests against the guide slot end.

On an annual basis the motor should be loosened from the body to clean the lead screw, re-loc-tite the nut locking the lead screw to the aluminum plunger, and to re-grease the O-rings. Use methanol to clean the plunger while it is removed. Verify proper concentricity between the lead screw and aluminum plunger by rotating the lead screw and visually verifying that the aluminum plunger does not 'wobble'. Clean the stainless steel body with methanol. Move the lead screw by hand and verify proper glide.